PROVIDING PROTECTION TO PEOPLE AND BUILDINGS

FEMA 452
Risk Assessment

A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings

A RMS Publication

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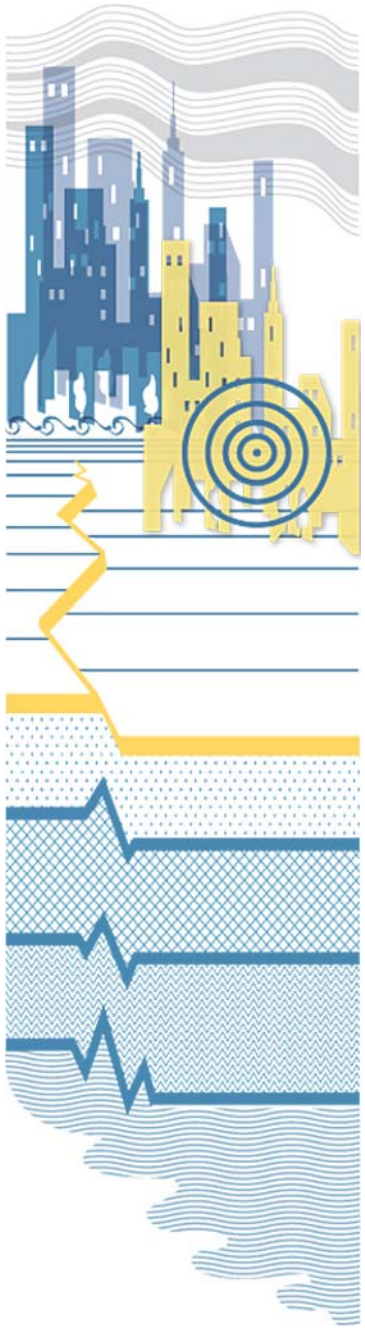

RMS Publications

EXISTING PUBLICATIONS

- **FEMA 426,** Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings
- **FEMA 427,** Primer for Design of Commercial Buildings to Mitigate Terrorist Attacks
- **FEMA 428,** Primer to Design Safe School Projects in Case of Terrorist Attacks
- **FEMA 429,** Insurance, Finance, and Regulation, Primer for Terrorist Rick Management in Buildings
- **E155**, Building Design for Homeland Security

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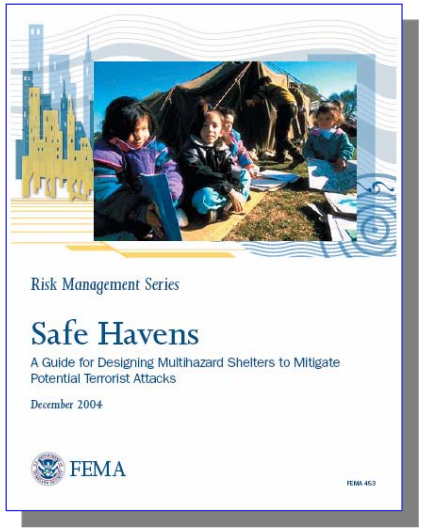
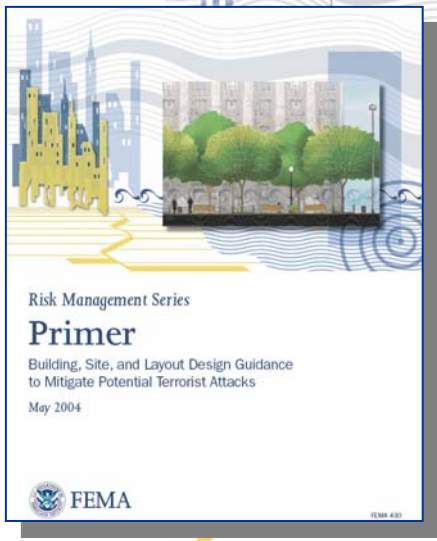
http://www.fema.gov/fima/rmsp.shtm

RMS Publications

FUTURE PUBLICATIONS

- **FEMA 430,** Primer for Incorporating Building Security Components in Architectural Design (50%)
- **FEMA 452,** Risk Assessment, A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings (90%)
- **FEMA 453,** Safe Havens, A Guide for Designing Multihazard Shelters to Mitigate Potential Terrorist Attacks (50%)
- **FEMA 455,** Rapid Visual Screening for Building Security (Starting 2004)
- **FEMA 459,** Incremental Rehabilitation to Improve Building Security (Starting 2004)





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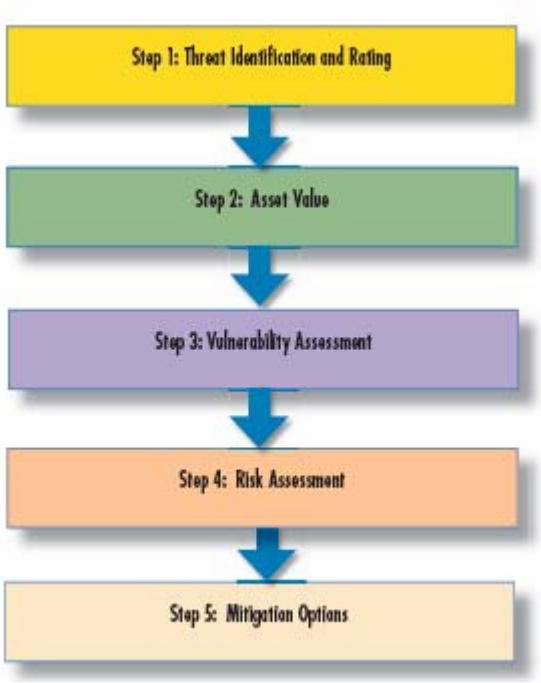
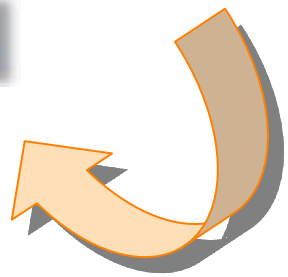
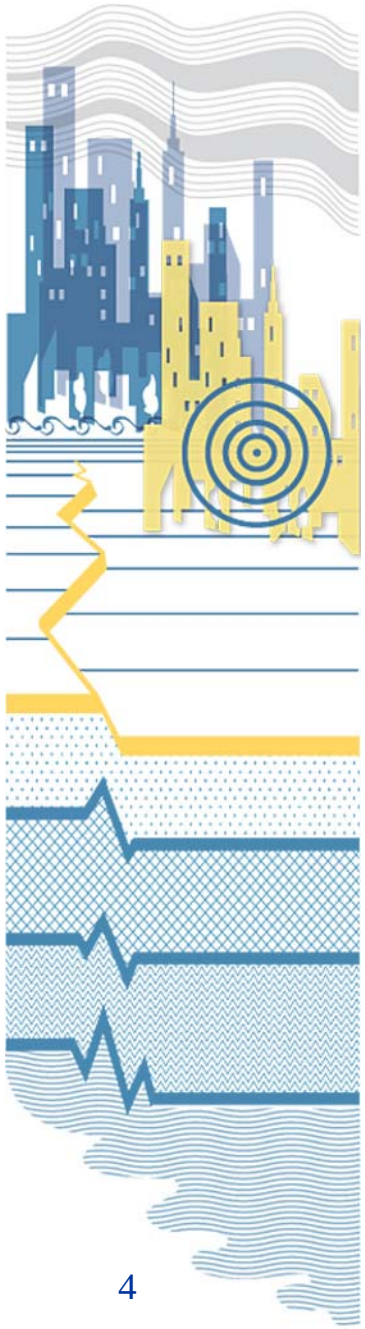
FEMA 452- Risk Assessment: A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings



Working Closely with VA





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Building Vulnerability Checklist

- Step by Step Process
- 48-page Checklist

Section	Vulnerability Question	Guidance	Observations
1	Site		
1.1	What major structures surround the facility (site or building(s))? What critical infrastructure, government, military, or recreation facilities are in the local area that impact transportation, utilities, and collateral damage (attack at this facility impacting the other major structures or attack on the major structures impacting this facility)? What are the adjacent land uses immediately outside the perimeter of this facility (site or building(s))?	**Critical infrastructure to consider includes:** **Telecommunications infrastructure** Facilities for broadcast TV, cable TV; cellular networks; newspaper offices, production, and distribution; radio stations; satellite base stations; telephone trunking and switching stations, including critical cable routes and major rights-of-way **Electric power systems** Power plants, especially nuclear facilities; transmission and distribution system components; fuel distribution, delivery, and storage **Gas and oil facilities** Hazardous material facilities, oil/gas pipelines, and storage facilities	

- Site
- Architectural
- Structural Systems
- Building Envelope
- Utility Systems
- Mechanical Systems (heating, ventilation, and air conditioning [HVAC] and CBR)
- Plumbing and Gas Systems
- Electrical Systems
- Fire Alarm Systems
- Communications and Information Technology (IT) Systems
- Equipment Operations and Maintenance
- Security Systems

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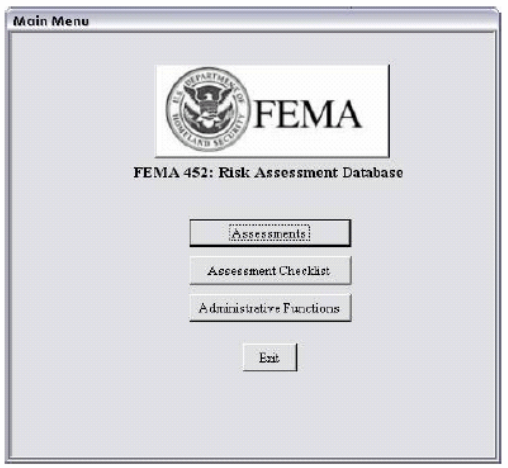
Automated Software to Prepare Risk Assessment



- Used in the preparation of the VA Assessment
- Prioritizes major vulnerabilities in a particular building
- Prioritizes major vulnerabilities among a large stock of buildings
- Identifies and rank mitigation measures
- Produces risk assessments reports

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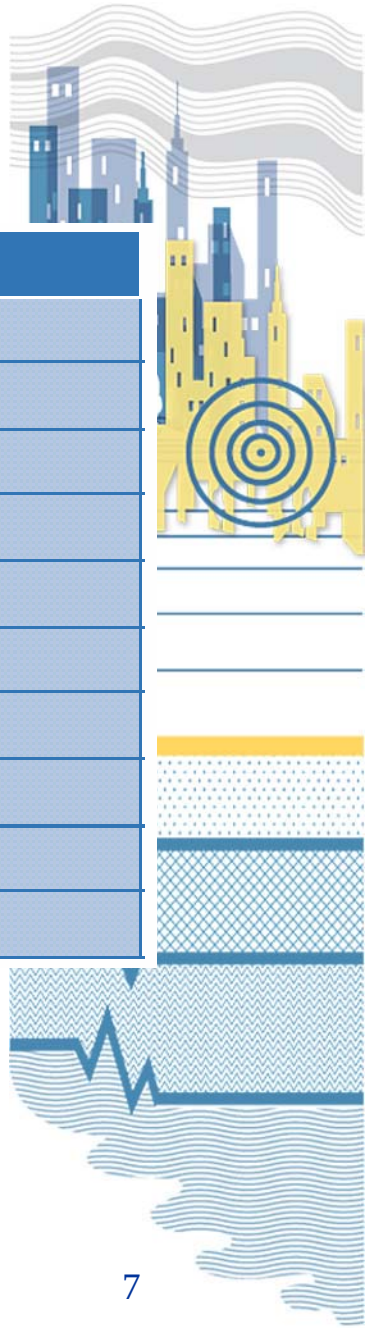
Methodology

Core Functions
Administration
Engineering
Warehousing
Data Center
Food Service
Security
Housekeeping
Day Care

Building Infrastructure
Site
Architectural
Structural Systems
Envelope Systems
Utility Systems
Mechanical Systems
Plumbing and Gas Systems
Electrical Systems
Fire Alarm Systems
IT/Communications Systems



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Type of Assessment and Team Composition

Screening Phase

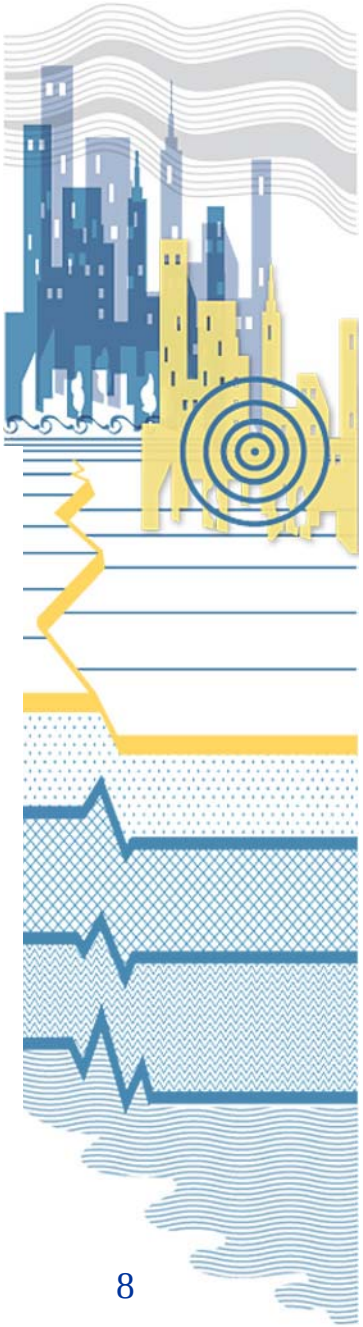
(1) Site and Architectural; (1) Security System and Operations **(1 day)**

Full on Site Evaluation

(1) Site and Architectural; (1) Structural and Building Envelope; (1) Mechanical, Electrical, Power systems and Site Utilities; (1) IT and Telecom; (1) Security Systems and Operations (1-3 days)

Detailed Evaluation

Site and Architectural; (1) Structural and Building Envelope; (1) Mechanical, Electrical, Power systems and Site Utilities; (1) IT and Telecom Modeler; (1) Security Systems and Operations; (1) Explosive Blast Modeler; 1 CBR Modeler; 1 Cost Engineer



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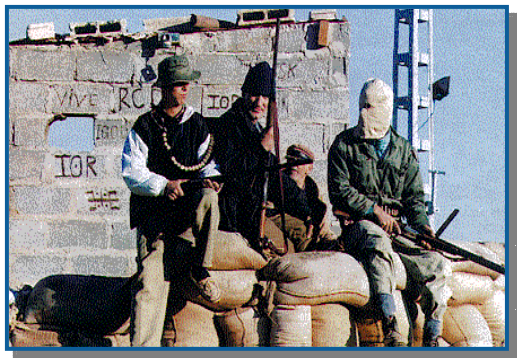
STEP 1: THREAT – Any indication, circumstance, or event with the potential to cause loss of, or damage to an asset

Involves two activities:

- **Selection of Primary Threats:** tools and tactics as well as people with intent to cause harm
- **Determining the threat rating:** a parameter use to quantify your losses



Weapons, tools, and tactics can change faster than a building can be modified

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Activity 1: Selection of Primary Threats

Criteria

Criteria							
Scenario	Access to Agent	Knowledge/ Expertise	History of Threats (Building Functions/ Tenants)	Asset Visibility/ Symbolic	Asset Accessibility	Site Population/ Capacity	Collateral Damage/Distance to Building
9-10	Readily available	Basic knowledge/ open source	Local incident	Existence widely known/ Iconic	Open access, unrestricted parking	> 5,000	Within 1,000-foot radius
6-8	Easy to produce	Bachelor's degree or technical school/open scientific or technical literature	Regional/ State	Existence locally known/ landmark	Open access, restricted parking	1,001-5,000	Within 1-mile radius
3-5	Difficult to produce or acquire	Advanced training/rare scientific or declassified literature	National	Existence publish/well-known	Controlled access, protected entry	251-1,000	Within 2-mile radius
1-2	Very difficult to produce or acquire	Advanced degree or training/ classified information	International	Existence not well-known/ No symbolic importance	Remote location, secure perimeter, armed guards, tightly controlled access	1-250	Within 10-mile radius

Sophisticated Methods include TM5-853 Army-Air Force Engineering Manual; State of Florida HLS-CAM; and the DoD CARVER process

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Selected Threats

- **Vehicle Bomb.** 500-lb. car bomb detonating within 15 feet of building exterior
- **Suicide Bomber.** 50-lb. satchel or vest detonating in interior space or near primary structural member
- **Chemical Agent.** Sarin gas is most toxic of the listed agents; assumed worst case
- **Biological Agent.** Recent mail attacks with Ricin, no antidote, high economic productivity loss
- **Cyber.** Impact on telecommunications and security systems

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Activity 2: Determining Threat Rating

Threat Rating		
Very High	10	Very High - The likelihood of a threat, weapon and tactic being used against the site or building is immeninet, internal decision makers and/or external law enforcment and intelligence agencies determine the threat is crdible
High	8-9	High -The likelihood of a threat, weapon and tactic being used against the site or building is expected, internal decision makers and/or external law enforcment and intelligence agencies determine the threat is crdible
Medium High	7	Medium High- The likelihood of a threat, weapon and tactic being used against the site or building is probable, internal decision makers and/or external law enforcment and intelligence agencies determine the threat is crdible
Medium	5-6	Medium - The likelihood of a threat, weapon and tactic being used against the site or building is possible, internal decision makers and/or external law enforcment and intelligence agencies determine the threat is known but not verified
Medium Low	4	Medium Low-The likelihood of a threat, weapon and tactic being used in the region is probable, internal decision makers and/or external law enforcment and intelligence agencies determine the threat is known but not likely.
Low	2-3	Low- The likelihood of a threat, weapon and tactic being used in the region is possible, internal decision makers and/or external law enforcment and intelligence agencies determine the threat exists but not likel;y
Very Low	1	Very Low - The likelihood of a threat, weapon and tactic being used in the region or against the site or building is very negligible, internal decision makers and/or external law enforcment and intelligence agencies determine the threat is non-existent or extremely unlikely.

Key elements

- Likelihood of a threat (credible, verified, exists, unlikely, unknown)
- If the use of the weapon is considered imminent, expected, or probable

Function	Cyber Attack	Armed Attack (single gunman)	Vehicle Bomb	CBR Attack
Administration				
Asset Value	5	5	5	5
Threat Rating	8	4	3	2
Vulnerability Rating				
Engineering				
Asset Value	8	8	8	8
Threat Rating	8	5	6	2
Vulnerability Rating				

Infrastructure	Cyber Attack	Armed Attack (single gunman)	Vehicle Bomb	CBR Attack
Site				
Asset Value	4	4	4	4
Threat Rating	4	4	3	2
Vulnerability Rating				
Structural Systems				
Asset Value	8	8	8	8
Threat Rating	3	4	3	3
Vulnerability Rating				

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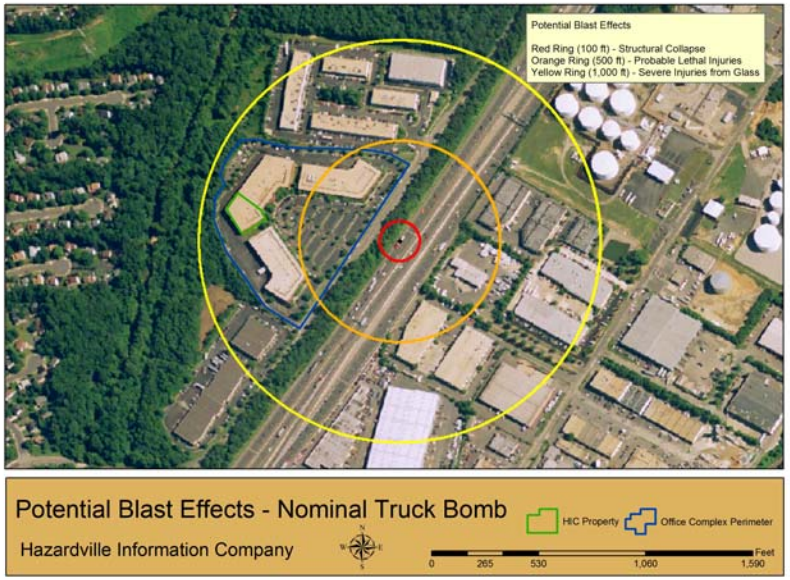
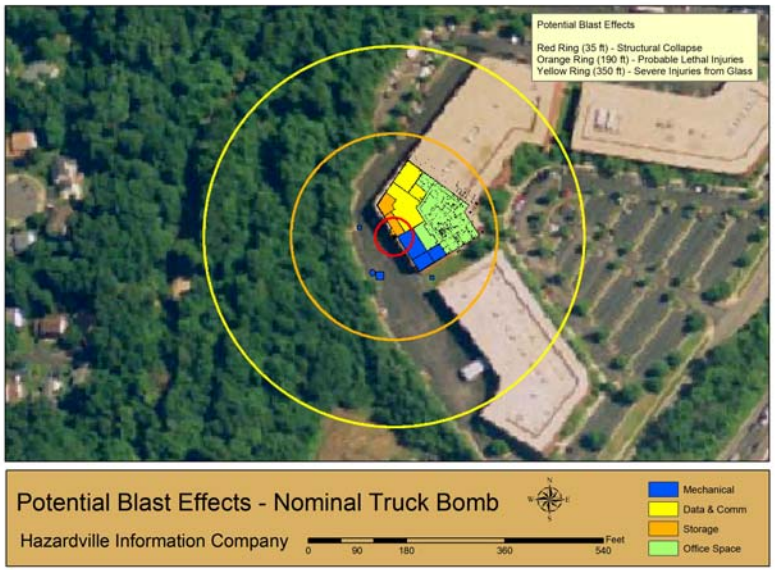
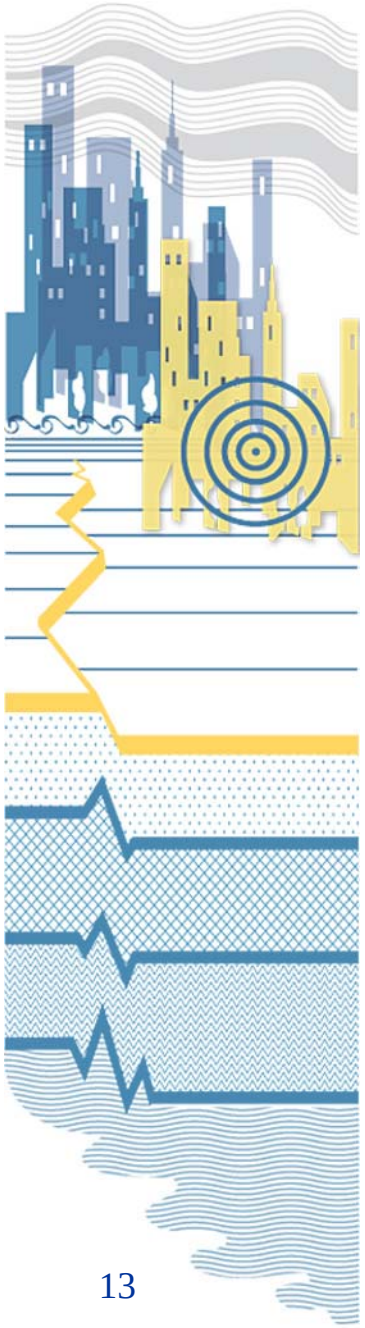
STEP 2:
ASSET VALUE

The degree of debilitating impact that would be caused by the destruction of an asset







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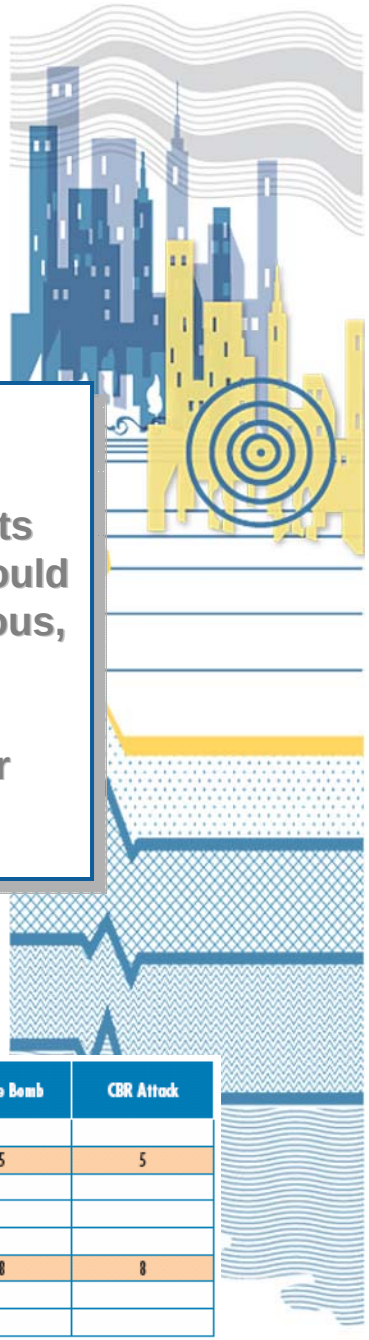
Asset Value Rating

Asset Value		
Very High	10	Very High – Loss or damage of the building's assets would have exceptionally grave consequences, such as extensive loss of life, widespread severe injuries, or total loss of primary services, core processes, and functions.
High	8-9	High – Loss or damage of the building's assets would have grave consequences, such as loss of life, severe injuries, loss of primary services, or major loss of core processes and functions for an extended period of time.
Medium High	7	Medium High – Loss or damage of the building's assets would have serious consequences, such as serious injuries or impairment of core processes and functions for an extended period of time.
Medium	5-6	Medium – Loss or damage of the building's assets would have moderate to serious consequences, such as injuries or impairment of core functions and processes.
Medium Low	4	Medium Low – Loss or damage of the building's assets would have moderate consequences, such as minor injuries or minor impairment of core functions and processes.
Low	2-3	Low – Loss or damage of the building's assets would have minor consequences or impact, such as a slight impact on core functions and processes for a short period of time.
Very Low	1	Very Low – Loss or damage of the building's assets would have negligible consequences or impact.

Key elements

- **Loss of assets and/or people would have grave, serious, moderate, or negligible consequences or impact**



Infrastructure	Cyber Attack	Armed Attack (single gunman)	Vehicle Bomb	CBR Attack
Site				
Asset Value	4	4	4	4
Threat Rating				
Vulnerability Rating				
Structural Systems				
Asset Value	8	8	8	8
Threat Rating				
Vulnerability Rating				

Function	Cyber Attack	Armed Attack (single gunman)	Vehicle Bomb	CBR Attack
Administration				
Asset Value	5	5	5	5
Threat Rating				
Vulnerability Rating				
Engineering				
Asset Value	8	8	8	8
Threat Rating				
Vulnerability Rating				

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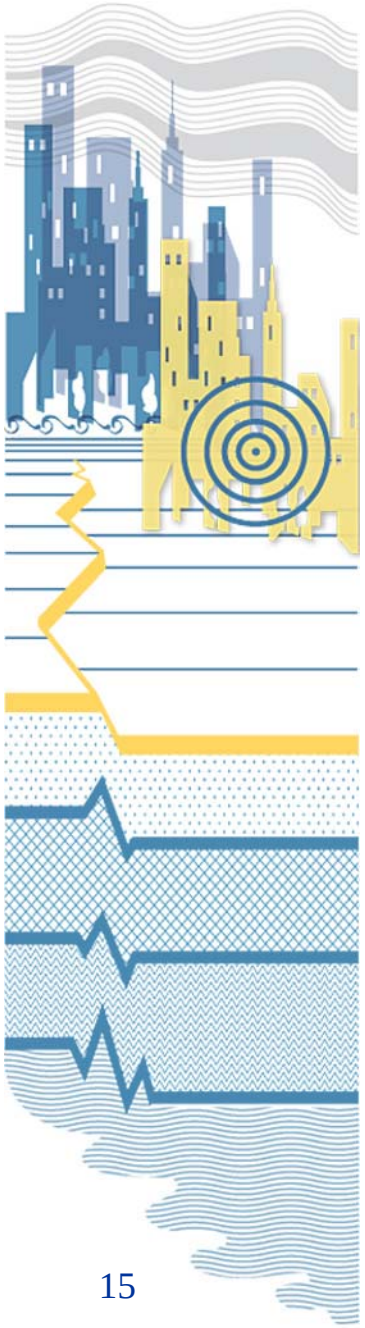
STEP 3: Vulnerability – Any weakness that can be exploited by an aggressor to make an asset susceptible to damage

YIELD (≈TNT Equiv.)
4,000 lb.
Stand-off
15 feet
166 killed

Murrah Federal Building

Khobar Towers

YIELD (≈TNT Equiv.)
20,000 lb.
Stand-off
80 feet
19 killed



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Vulnerability Rating

Criteria		
Very High	10	Very High – One or more major weaknesses have been identified that make the asset extremely susceptible to an aggressor or hazard. The building lacks redundancies/ physical protection and the entire building would be only functional again after a very long period of time after the attack.
High	8-9	High – One or more major weaknesses have been identified that make the asset highly susceptible to an aggressor or hazard. The building has poor redundancies/ physical protection and most part of the building would be only functional again after a long period of time after the attack.
Medium High	7	Medium High – An important weakness has been identified that makes the asset very susceptible to an aggressor or hazard. The building has inadequate redundancies/ physical protection and most critical functions would be only operational again after a long period of time after the attack.
Medium	5-6	Medium – A weakness has been identified that makes the asset fairly susceptible to an aggressor or hazard. The building has insufficient redundancies/physical protection and most part of the building would be only functional again after a considerable period of time after the attack.
Medium Low	4	Medium Low – A weakness has been identified that makes the asset somewhat susceptible to an aggressor or hazard. The building has incorporated a fair level of redundancies/physical protection and most critical functions would be only operational again after a considerable period of time after the attack.
Low	2-3	Low – A minor weakness has been identified that slightly increases the susceptibility of the asset to an aggressor or hazard. The building has incorporated a good redundancies/physical protection and the building would be operational within a short-period of time after an attack.
Very Low	1	Very Low – No weaknesses exist. The building has incorporated excellent redundancies/physical protection and the building would be operational immediately after an attack.

Key elements

- Number of weakness
- Aggressor potential accessibility
- Level of redundancies/physical protection
- Time frame for the building to become operational again

Infrastructure	Cyber Attack	Armed Attack (single gunman)	Vehicle Bomb	CBR Attack
Site				
Asset Value	4	4	4	4
Threat Rating	4	4	3	2
Vulnerability Rating	3	5	9	9
Structural Systems				
Asset Value	8	8	8	8
Threat Rating	3	4	3	3
Vulnerability Rating	2	4	8	9

Function	Cyber Attack	Armed Attack (single gunman)	Vehicle Bomb	CBR Attack
Site				
Asset Value	5	5	5	5
Threat Rating	8	4	3	2
Vulnerability Rating	7	7	9	9
Structural Systems				
Asset Value	8	8	8	8
Threat Rating	8	5	6	2
Vulnerability Rating	2	4	8	9

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STEP 4: Risk
The potential for loss of, or damage to, an asset. It is based upon the value of the asset in relation to the threats and vulnerabilities associated with it.

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Risk = Threat Rating x Asset Value x Vulnerability Rating

	Low Risk	Medium Risk	High Risk
Risk Factors Total	1-60	61-175	≥ 176

Function	Cyber Attack	Armed Attack (single gunman)	Vehicle Bomb	CBR Attack
Administration	280	140	135	90
Asset Value	5	5	5	5
Threat Rating	8	4	3	2
Vulnerability Rating	7	7	9	9
Engineering	128	128	192	144
Asset Value	8	8	8	8
Threat Rating	8	4	3	2
Vulnerability Rating	2	4	8	9
Warehousing	96	36	81	54
Asset Value	3	3	3	3
Threat Rating	8	4	3	2
Vulnerability Rating	4	3	9	9
Data Center	360	128	216	144
Asset Value	8	8	8	8
Threat Rating	9	4	3	2
Vulnerability Rating	5	4	9	9
Food Service	2	32	48	36
Asset Value	2	2	2	2
Threat Rating	1	4	3	2
Vulnerability Rating	1	4	8	9
Security	280	140	168	126
Asset Value	7	7	7	7
Threat Rating	8	4	3	2
Vulnerability Rating	5	5	8	9
Housekeeping	16	64	48	36
Asset Value	2	2	2	2
Threat Rating	8	4	3	2
Vulnerability Rating	1	8	8	9
Day Care	54	324	243	162
Asset Value	9	9	9	9
Threat Rating	3	4	3	2
Vulnerability Rating	2	9	9	9

Infrastructure	Cyber Attack	Armed Attack (single gunman)	Vehicle Bomb	CBR Attack
Site	48	80	108	72
Asset Value	4	4	4	4
Threat Rating	4	4	3	2
Vulnerability Rating	3	5	9	9
Architectural	40	40	135	20
Asset Value	5	5	5	5
Threat Rating	8	4	3	2
Vulnerability Rating	1	2	9	2
Structural Systems	24	32	240	16
Asset Value	8	8	8	8
Threat Rating	3	4	3	2
Vulnerability Rating	1	1	10	1
Envelope Systems	84	112	189	112
Asset Value	7	7	7	7
Threat Rating	6	4	3	2
Vulnerability Rating	2	4	9	8
Utility Systems	112	56	168	42
Asset Value	7	7	7	7
Threat Rating	8	4	3	2
Vulnerability Rating	2	2	8	3
Mechanical Systems	42	56	105	126
Asset Value	7	7	7	7
Threat Rating	6	4	3	2
Vulnerability Rating	1	2	5	9
Plumbing and Gas Systems	40	40	120	70
Asset Value	5	5	5	5
Threat Rating	8	4	3	2
Vulnerability Rating	1	2	8	7
Electrical Systems	42	84	189	28
Asset Value	7	7	7	7
Threat Rating	8	4	3	2
Vulnerability Rating	1	3	9	2
Fire Alarm Systems	162	108	216	36
Asset Value	9	9	9	9
Threat Rating	6	4	3	2
Vulnerability Rating	3	3	8	2
IT/Communications Systems	512	64	192	32
Asset Value	8	8	8	8
Threat Rating	8	4	3	2
Vulnerability Rating	8	2	8	2

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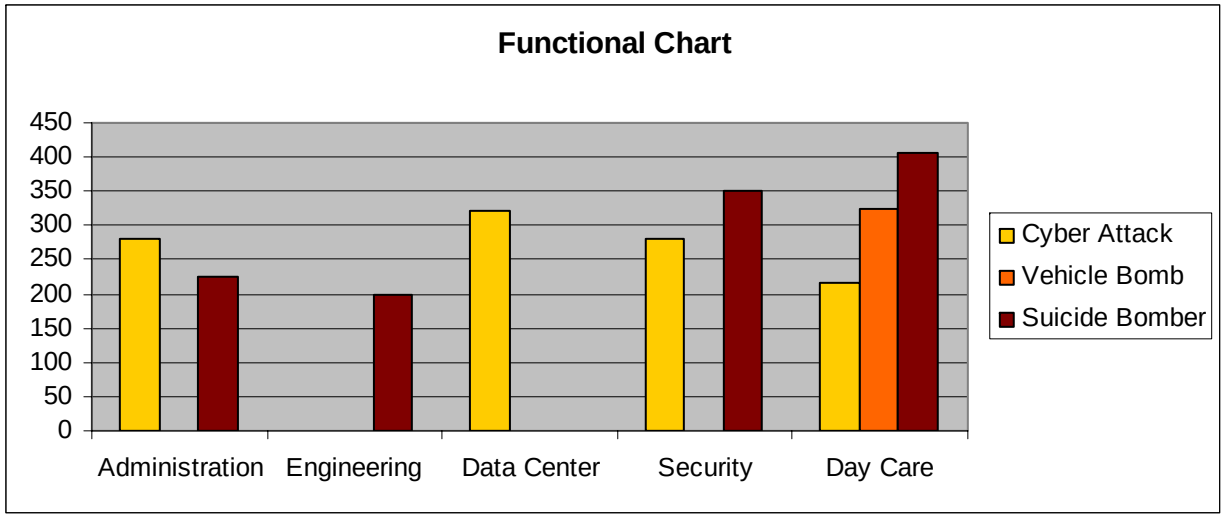
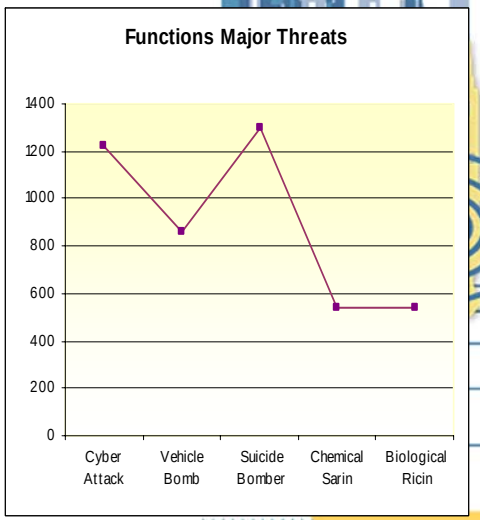
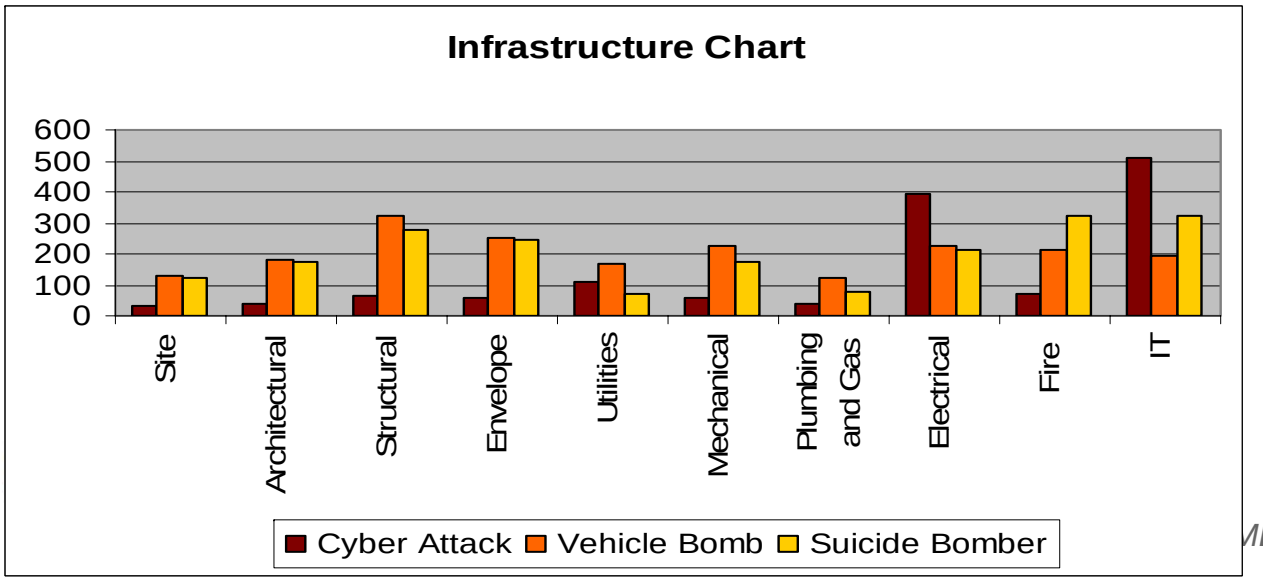
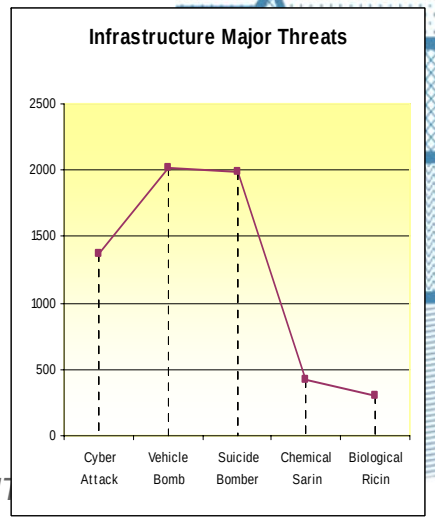

Functional Chart
450
400
350
300
250
200
150
100
50
0
Administration
Engineering
Data Center
Security
Day Care
Cyber Attack
Vehicle Bomb
Suicide Bomber


Functions Major Threats
1400
1200
1000
800
600
400
200
0
Cyber Attack
Vehicle Bomb
Suicide Bomber
Chemical Sarin
Biological Ricin


Infrastructure Chart
600
500
400
300
200
100
0
Site
Architectural
Structural
Envelope
Utilities
Mechanical
Plumbing and Gas
Electrical
Fire
IT
Cyber Attack
Vehicle Bomb
Suicide Bomber


Infrastructure Major Threats
2500
2000
1500
1000
500
0
Cyber Attack
Vehicle Bomb
Suicide Bomber
Chemical Sarin
Biological Ricin

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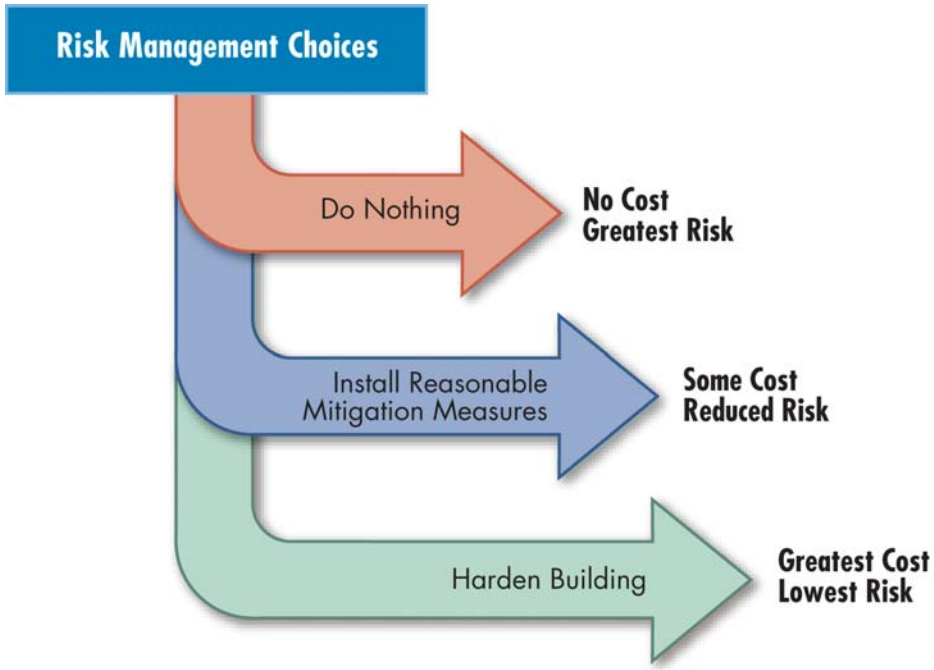
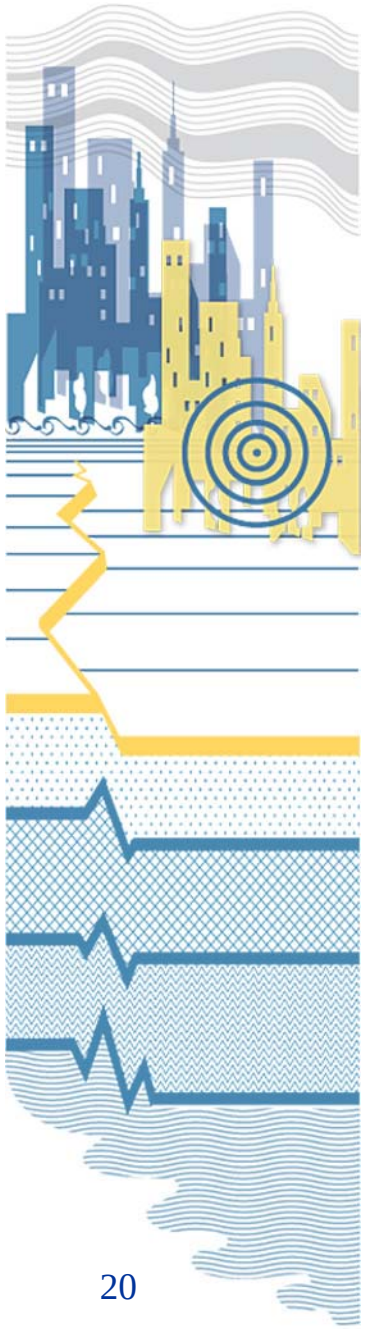
STEP 5: Mitigation

Actions taken to reduce the exposure to an impact of an attack or disaster





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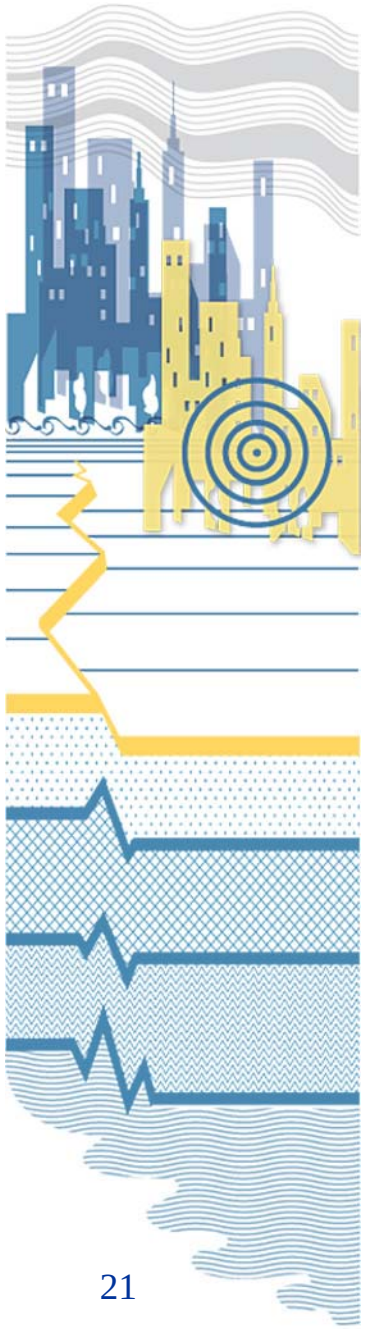
Prioritizing Mitigation Options

	Available Political Support	Community Acceptance	Cost	Benefit	Available Financial Resources	Legal Authority	Adversely Affected Population	Environmental Impact	Technical Capacity	Funding for Maintenance/Operations	Easy and Speed of Implementation	Timeframe and Urgency	Short-Term Solutions Benefits	Long-Term Solutions Benefits	Others	Others
Mitigation 1																
Mitigation 2																
Mitigation 3																
Mitigation 4																
Mitigation 5																
Mitigation 6																
Mitigation 7																

Short List of Mitigation Options for Blast	
Option 2	
Option 3	
Option 3	

Short List of Mitigation Options for CBR	
Option 1	



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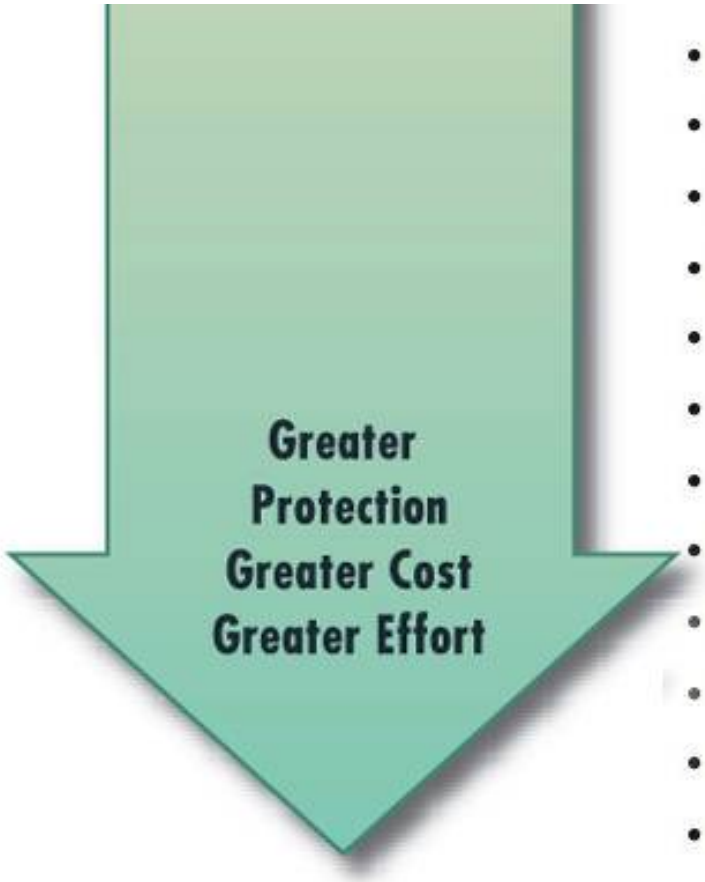
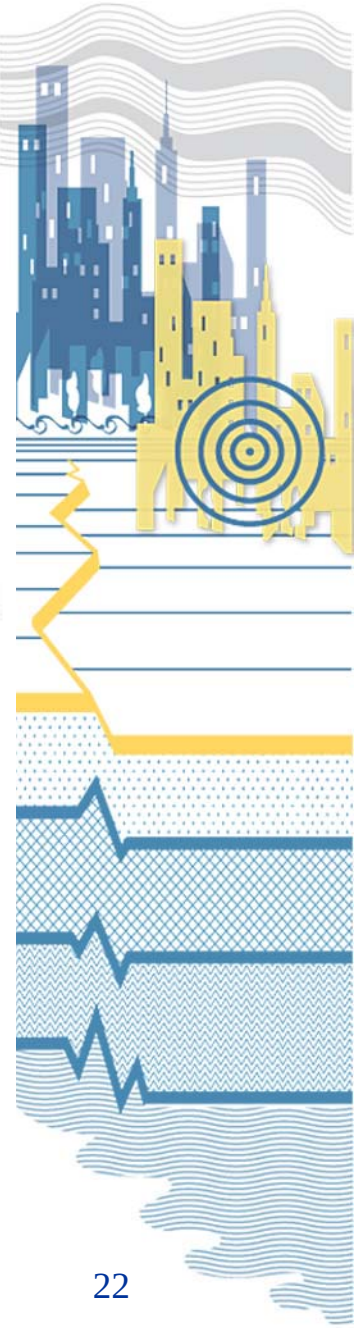
STEP 5: Selecting Mitigation Options



- Install an internal public address system.
- Stagger interior doors and offset interior and exterior doors.
- Eliminate hiding places.
- Install a second and separate telephone service.
- Install radio telemetry distributed antennas throughout the facility.
- Use a badge identification system for building access.
- Install a CCTV surveillance system.
- Install an electronic security alarm system.
- Install rapid response and isolation features into HVAC systems.
- Use interior barriers to differentiate levels of security.
- Locate utility systems away from likely areas of potential attack.
- Install call buttons at key public contact areas.



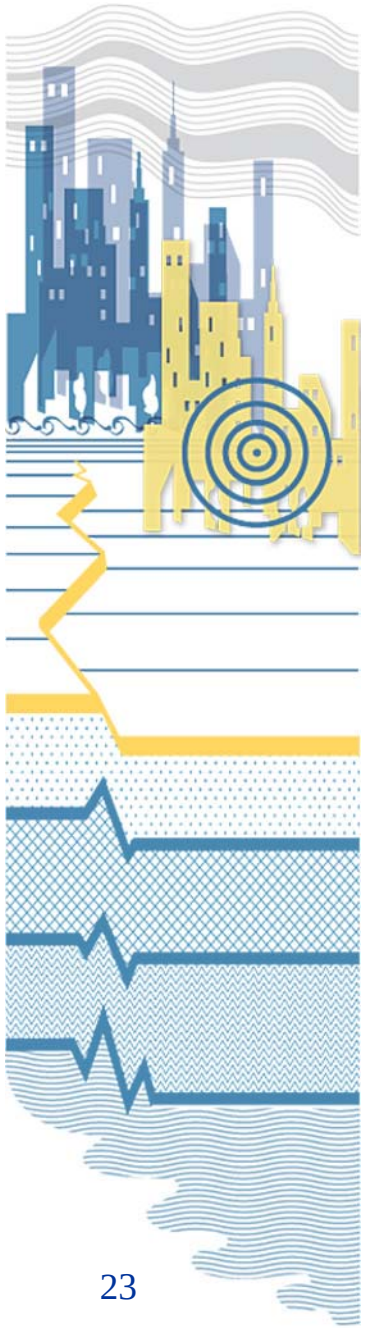
FEMA

FEMA 452

Next Steps

- **Add multihazard concepts and capabilities to FEMA 452 and Database**

- **Expand the Database function to allow the user to add unlimited number of threats and building functions and infrastructure**



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